EOS StainlessSteel 316L

EOS StainlessSteel 316L is a corrosion resistant iron based alloy which has been optimized for processing on EOS DMLS systems. This document provides information and data for parts built using:

- EOS Powder: StainlessSteel 316L (EOS art.-no. 9011-0032)
- EOS Laser Sintering Machine: EOS M400-4
  - HSS Recoater Blade (EOS art.-no. 300007610)
  - DirectBase S40 building platform (EOS art.-no. 300000729)
  - Argon atmosphere
  - 63 µm mesh for powder sieving recommended (EOS art.-no. 9044-0032 for IPCM M Extra Sieving Module or EOS art.-no. 200001059 for IPM M Powder Station L)
  - EOSYSTEM v. 2.6 or higher
- EOS Software:
  - EOSPRINT v. 1.6 (EOS art.-no. 7501-4031) / 2.0 (EOS art.-no. 7012-0119) or higher
- EOS Process:
  - 316L ParameterEditor (EOS art.-no. 7500-3087)
  - Name of the Default Job: 316L_040_FlexM404_100.eosjob

Description

EOS StainlessSteel 316L has chemical composition corresponding to ASTM F138 "Standard Specification for Wrought 18Cr-14Ni-2.5Mo Stainless Steel Bar and Wire for Surgical Implants (UNS S31673)". This kind of stainless steel is characterized having a good corrosion resistance and evidence that there are no leachable substances in cytotoxic concentrations.

This material is ideal in lifestyle/consumer applications, e.g. watches, other jewellery, spectacle frames, decorations, automotive/Industrial applications, aerospace/Turbine industry and as entry-level material for laser sintering technology.

Parts built from EOS StainlessSteel 316L can be machined, shot-peened and polished in as-built or stress relieved (AMS2759) states if required. Solution annealing is not necessary because the mechanical properties of as-built state are showing desired values (ASTM A403).

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Parts are not ideal in temperature range 427°C - 816°C where precipitation of chromium carbides occurs. Due to layer-wise building method, the parts have a certain anisotropy.

Technical Data

Powder properties

Material composition	Element	Min. [wt.-%]	Max [wt.-%]
	Fe	Balance	
	Cr	17.00	19.00
	Ni	13.00	15.00
	Mo	2.25	3.00
	C	-	0.030
	Mn	_	2.00
	Cu	_	0.50
	P	_	0.025
	S	_	0.010
	Si	_	0.75
	N	-	0.10
Max. particle size			
>63µm [1]	≤1.0 wt%		

[1] Sieve analysis according to ASTM B214.

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General process data

Layer thickness	40 µm
Volume rate [2]	Up to 4 x 3.7 mm³/s (4 x 13.3 cm³/h)

[2] The volume rate is a measure of build speed during laser exposure of the skin area per laser scanner. The total build speed depends on this volume rate and other factors such as exposure parameters of contours, supports, up- and downskin, recoating time, Home-In or LPM settings, job design (load, part geometry or overlap settings).

Physical and chemical properties of parts

Part density [3]	Approx. 7.9 g/ cm³
Surface roughness after shot peening [4]	Ra 3-8 µm; Rz 20-45 µm

[3] Weighing in air and water according to ISO 3369.
[4] Measurement according to ISO 4287. The numbers were measured at the horizontal (up-facing) and all vertical surfaces of test cubes. Due to the layerwise building the roughness strongly depends on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect.

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Tensile data at room temperature [5, 6]

	As built	
	Horizontal	**Vertical**
Ultimate tensile strength, Rm	650 MPa	590 MPa
Yield strength, Rp0.2	550 MPa	490 MPa
Elongation at break, A [7]	40 %	45 %

[5] Tensile testing according to ISO 6892-1:2016 B10, proportional test pieces, diameter of the neck area 5mm, gauge length 4D = 20.0mm, stress rate 10MPa/s, strain speed in plastic region 0.375 1/min

[6] The numbers are average values determined from samples with horizontal and vertical orientation respectively

[7] Elongation values are averaged and subject to variations depending on process conditions

Hardness in as built condition

Hardness as build HRB [8]	90 HRB

[8] Rockwell hardness (HRB) measurement according to EN ISO 6508-1 on ground surface.

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Abbreviations

typ. typical

min. minimum

max. maximum

wt. weight

Legal notes

The quoted values refer to the use of this material with above specified EOS DMLS system, EOSYSTEM software version, parameter set and operation in compliance with parameter sheet and operating instructions. All measured values are average numbers. Part properties are measured with specified measurement methods using defined test geometries and procedures. Further details of the test procedures used by EOS are available on request. Any deviation from these standard settings may affect the measured properties.

The data correspond to EOS knowledge and experience at the time of publication and they are subject to change without notice as part of EOS' continuous development and improvement processes.

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